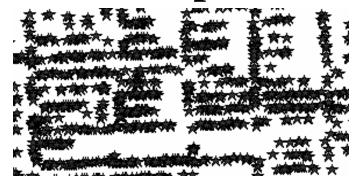# *Mobile Geocoding and Mapping: Geographic Analysis on the Laptop*

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F. Bruce Coles, D.O.

New York State Department of Health

Objectives

- remote table connection strategies

- basics of interactive geocoding

- geocoding warehouse architecture

- an integrated geocoding/contact tracing application

Geocoding

What is geocoding?

- Assigning geographic coordinates for addresses
- Representing coordinates with geographic layers
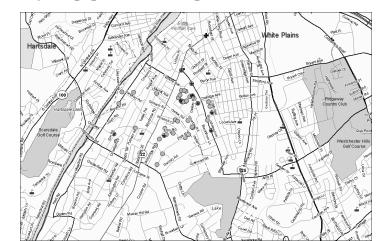
Geocoding Process
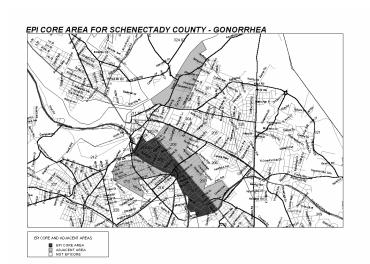
Stand-Alone

- **Batch processing**
- **Interactive review**

Geographic Layers

- **Layers can be single or multiple overlays**

- **Same data can be viewed in multiple layers**
  - **(e.g. "john smith, 12 bluebird lane" as**
    - **Morbidity**
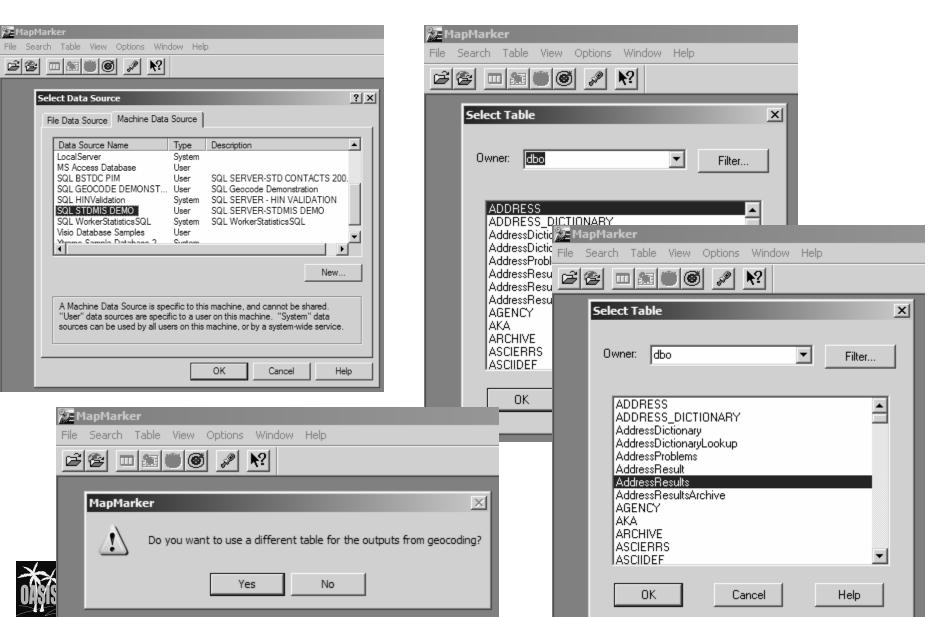   - **Field investigation**
    - **Interview**

My old paper route example

EPI CORE AREA FOR SCHENECTADY COUNTY - GONORRHEA

The Stand-alone Geocode Process

The Stand-alone Geocode Process

The Stand-alone Geocode Process

Imperfect Data

Multiple issues affect geocoding success

- **Mis-spelled street names**
- **Zip code errors**
- **Facility addresses**
- **Streets that don't exist**
- **Missing directional (East, West)**
- **Missing street numbers**
- **Out of range street numbers**

Integrated Geocoding

- **Not a stand-alone process**
- **Geocode control embedded in application**
- **Functionality interacts with application**
- **Links directly to disease investigation system**
- **Can be modified to suit your needs**
- **Control of matching process is local**
- **Address can be edited based on reference data**

Geocoding Process

Stand-Alone

- **Batch**

- **Interactive**

Integrated

- **Stand-alone batch**

- **Stand-alone interactive review**

- **Integrated interactive**

- **Feedback loop to point-of-source**

- **2nd interactive review**

Mobile Geocoding

Integration improves mobile geocoding
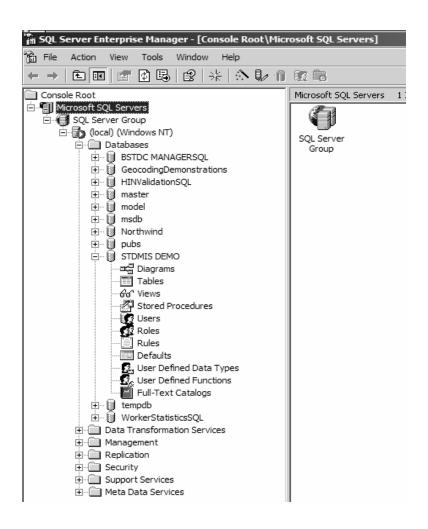
- **Real-time address confirmation**
- **Improves quality of location data**
- **Standardizes address data**
- **Gives feedback to address collectors**

DataBase– SQL Server
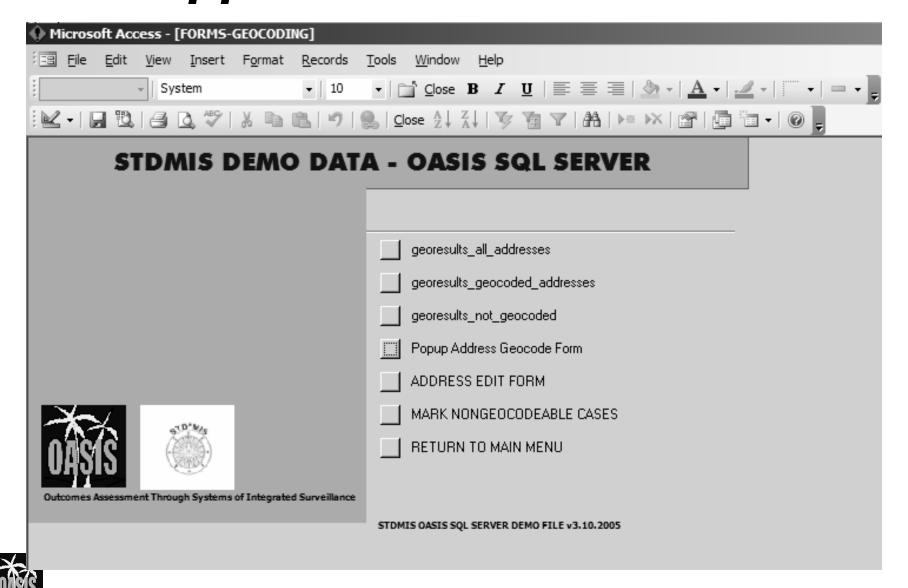
- **RDBMS backend can be synchronized to Enterprise database**

- **Web front-end is possible**
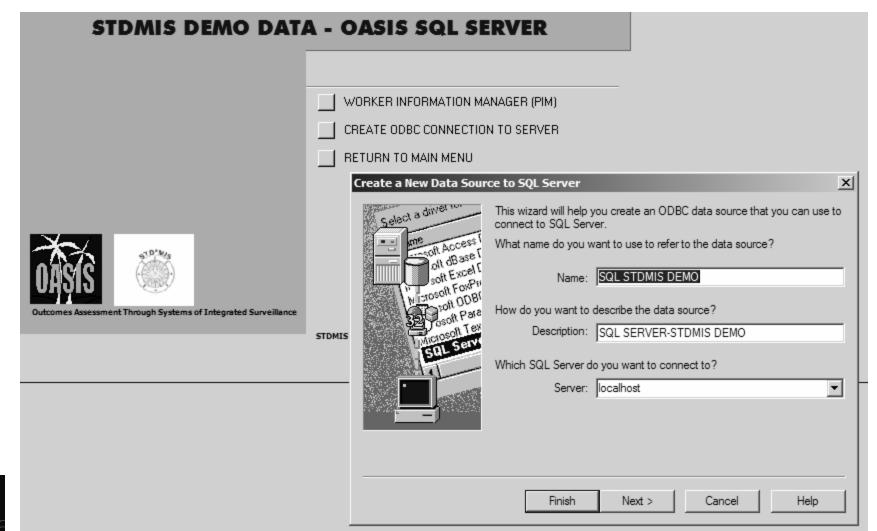
Application - MS Access
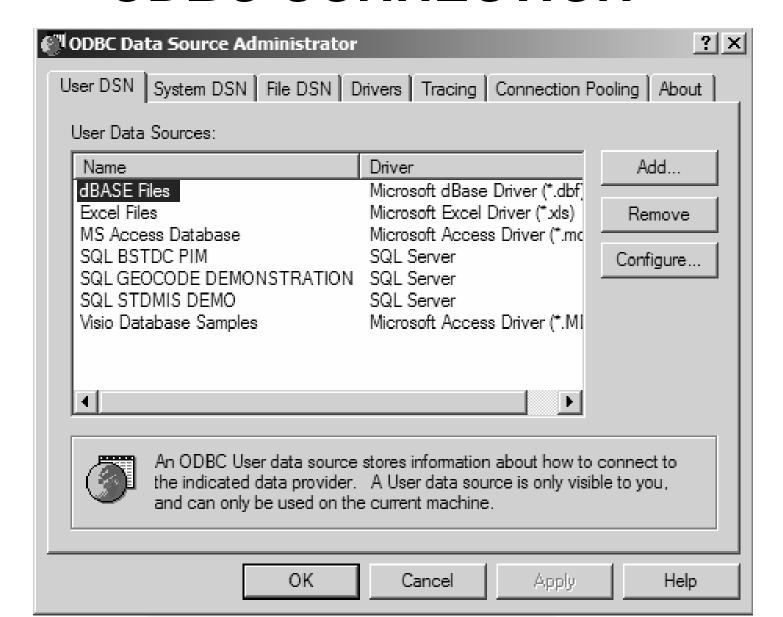
Automated ODBC Connection
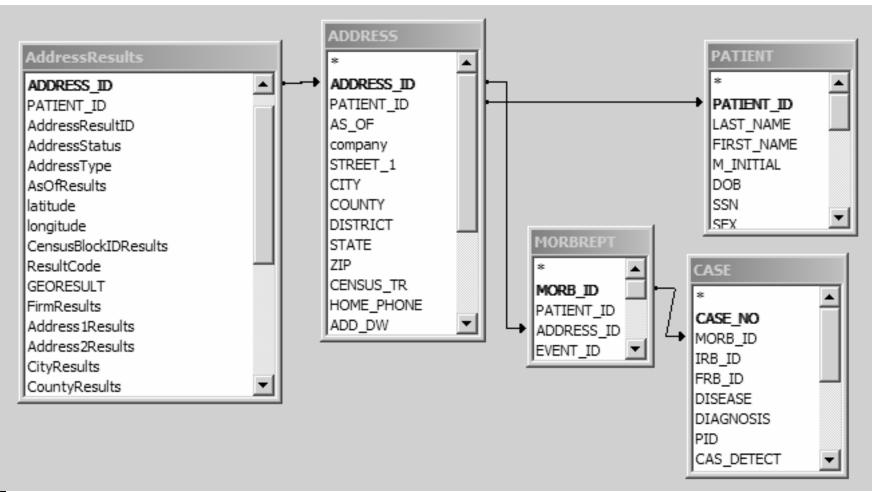
ODBC CONNECTION

Geocoding Architecture
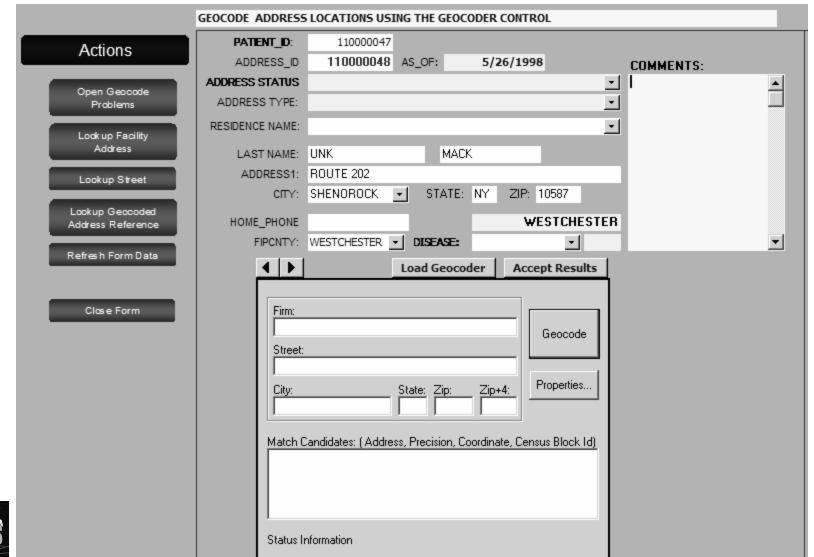
Multi-table Query

The Geocode Applicaton

GEOCODE ADDRESS LOCATIONS USING THE GEOCODER CONTROL

Actions

Open Geocode Problems

Lookup Facility Address

Lookup Street

Lookup Geocoded Address Reference

Refresh Form Data

Close Form

PATENT_ID: 110000047

ADDRESS_ID 110000048   AS_OF: 5/26/1998

COMMENTS:

ADDRESS STATUS

ADDRESS TYPE:

RESIDENCE NAME:

LAST NAME: UNK   MACK

ADDRESS1: ROUTE 202

CITY: SHENOROCK   STATE: NY   ZIP: 10587

HOME_PHONE   WESTCHESTER

FIPCNTY: WESTCHESTER   DISEASE:

◄ ►   Load Geocoder   Accept Results

Firm:

Street:

City: State: Zip: Zip+4:

Geocode

Properties...

Match Candidates: (Address, Precision, Coordinate, Census Block Id)

Status Information

Filter Records by Disease
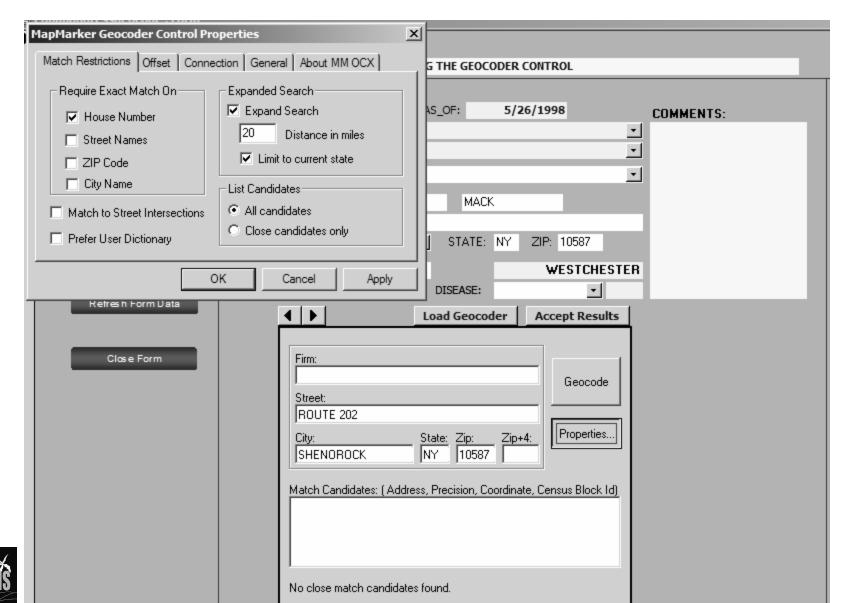
Load the Geocoder
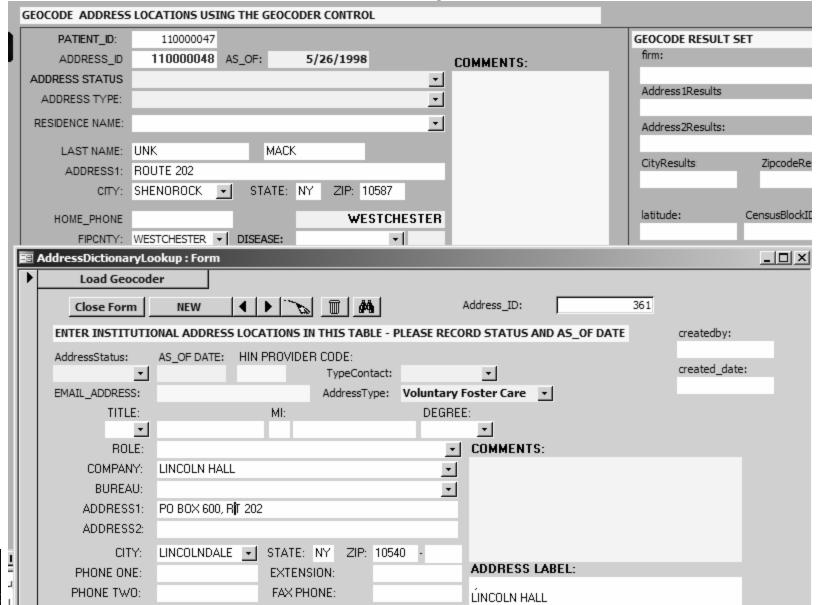
Change the Match Properties
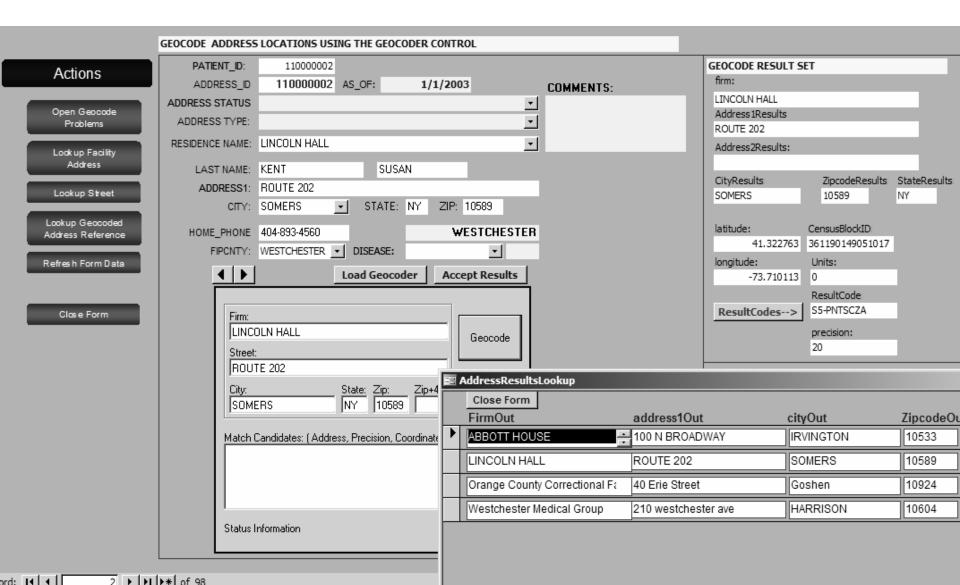
Log Problems

GEOCODE ADDRESS LOCATIONS USING THE GEOCODER CONTROL

PATIENT_ID: 110000047
ADDRESS_ID   **110000048**   AS_OF: **5/26/1998**

ADDRESS STATUS

ADDRESS TYPE:

RESIDENCE NAME:

LAST NAME: UNK   MACK
ADDRESS1: ROUTE 202
CITY: SHENOROCK   STATE: NY   ZIP: 10587

HOME_PHONE   **WESTCHESTER**
FIPCNTY: WESTCHESTER   DISEASE:

COMMENTS:

GEOCODE RESULT SET

firm:

Address1Results

Address2Results:

CityResults   ZipcodeResults   StateResults

latitude: CensusBlockID

longitude: Units:

ResultCode
ResultCodes-->   N

precision:

Load Geocoder   Accept Results

Firm:

Geocode

Street:
ROUTE 202

City: Stat
SHENOROCK   NY

Match Candidates: (Address, P

No close match candidates four

▶* of 99

p) test) add new

JP,FRB,REFERRAL

POPUP, MARK NONGEOCODEABLE CASES : Form

ADDRESS PROBLEMS FORM

Actions

Open Patient Data

Close Form

PATIENT_ID   ADDRESS_ID   RETURN STATUS: WORKER:
110000047   110000048   **NOT RETURNED**

lname: fname: GeoResult: DATE_RETURNED
UNK   MACK

address: city: zip: COU
ROUTE 202   SHENOROCK   10587   WEST

GEOCODE ERROR:

BLANK STREET ADDRESS LISTED
DIRECTIONAL (E, W, N, S) NOT SPECIFIED
FACILITY WITH UNKNOWN ADDRESS

Search Facility Addresses

GEOCODE ADDRESS LOCATIONS USING THE GEOCODER CONTROL

PATIENT_ID:	110000047
ADDRESS_ID:	110000048 AS_OF: 5/26/1998
ADDRESS STATUS	▼
ADDRESS TYPE:	▼
RESIDENCE NAME:	▼

COMMENTS:

GEOCODE RESULT SET

firm:

Address1Results

LAST NAME: UNK   MACK

ADDRESS1: ROUTE 202

Address2Results:

CITY: SHENOROCK ▼   STATE: NY   ZIP: 10587

CityResults   ZipcodeRe

HOME_PHONE _____   **WESTCHESTER**

latitude: CensusBlockID

FIPCNTY: WESTCHESTER ▼ | DISEASE: ▼ |

AddressDictionaryLookup : Form   _ □ ×

▶   **Load Geocoder**

Close Form **NEW** ◀ ▶ ◥ 🗑 🔍   Address_ID: 361

ENTER INSTITUTIONAL ADDRESS LOCATIONS IN THIS TABLE - PLEASE RECORD STATUS AND AS_OF DATE   createdby:

AddressStatus: AS_OF DATE: HIN PROVIDER CODE: created_date:
▼   TypeContact: ▼

EMAIL_ADDRESS: _____   AddressType: **Voluntary Foster Care** ▼

TITLE: MI: DEGREE:
▼   _____   _____   ▼

ROLE: ▼   **COMMENTS:**

COMPANY: LINCOLN HALL ▼

BUREAU: ▼

ADDRESS1: PO BOX 600, RT 202

ADDRESS2: _____

CITY: LINCOLNDALE ▼ STATE: NY ZIP: 10540 -

PHONE ONE: _____   EXTENSION: _____   **ADDRESS LABEL:**

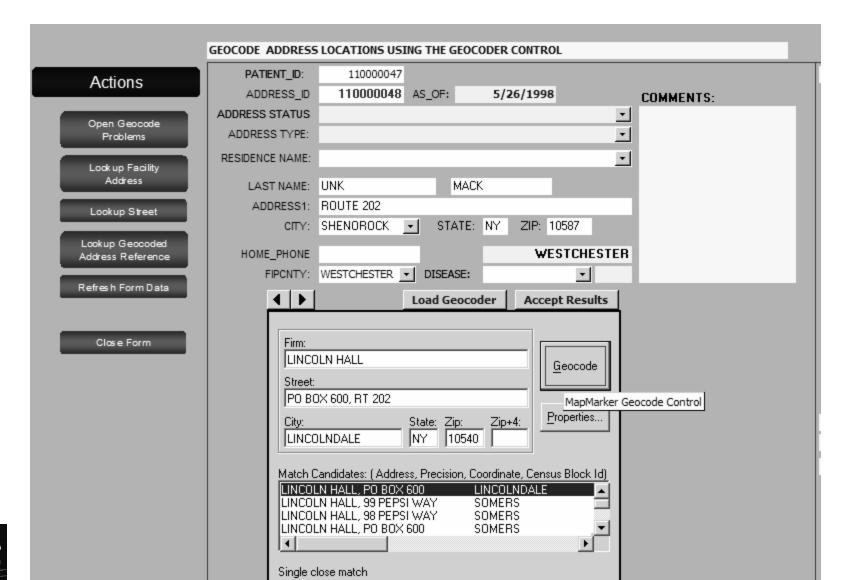PHONE TWO: _____   FAX PHONE: _____   LINCOLN HALL

OASIS

Recursive Query Searches
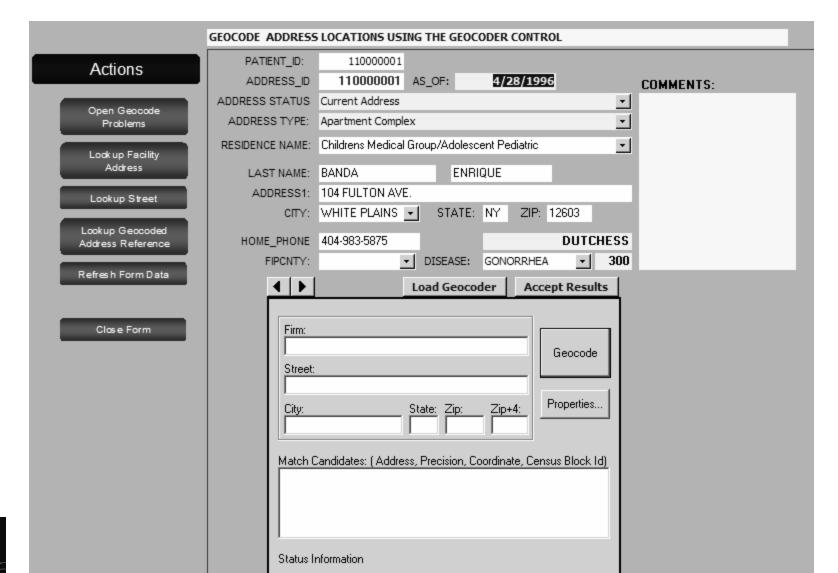
Select an Address Match

Address Status and Type
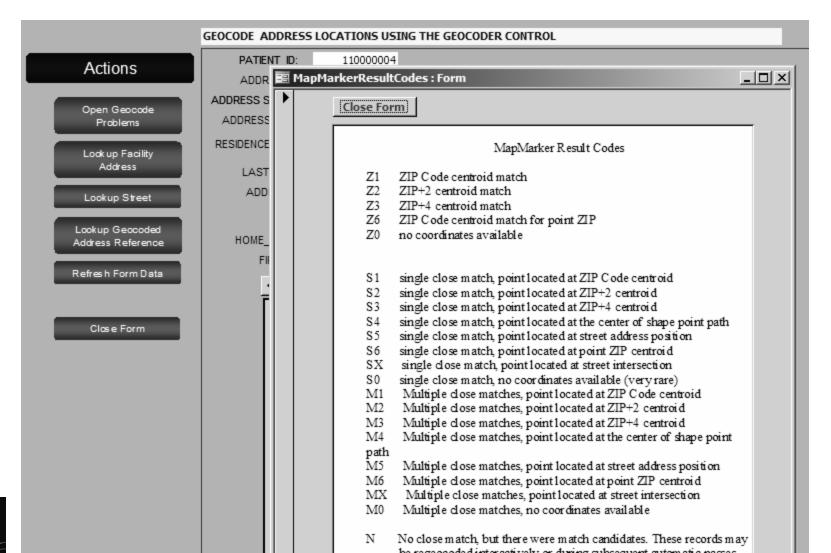
Address Status and Type

Result Codes

GEOCODE ADDRESS LOCATIONS USING THE GEOCODER CONTROL

PATIENT ID: 110000004

Actions

Open Geocode Problems

Lookup Facility Address

Lookup Street

Lookup Geocoded Address Reference

Refresh Form Data

Close Form

ADDR
ADDRESS S
ADDRESS
RESIDENCE
LAST
ADD
HOME_
FI

MapMarkerResultCodes : Form

Close Form

MapMarker Result Codes

Z1   ZIP Code centroid match
Z2   ZIP+2 centroid match
Z3   ZIP+4 centroid match
Z6   ZIP Code centroid match for point ZIP
Z0   no coordinates available

S1   single close match, point located at ZIP Code centroid
S2   single close match, point located at ZIP+2 centroid
S3   single close match, point located at ZIP+4 centroid
S4   single close match, point located at the center of shape point path
S5   single close match, point located at street address position
S6   single close match, point located at point ZIP centroid
SX   single close match, point located at street intersection
S0   single close match, no coordinates available (very rare)
M1   Multiple close matches, point located at ZIP Code centroid
M2   Multiple close matches, point located at ZIP+2 centroid
M3   Multiple close matches, point located at ZIP+4 centroid
M4   Multiple close matches, point located at the center of shape point path
M5   Multiple close matches, point located at street address position
M6   Multiple close matches, point located at point ZIP centroid
MX   Multiple close matches, point located at street intersection
M0   Multiple close matches, no coordinates available

N   No close match, but there were match candidates. These records may
      be regeocoded interactively or during subsequent automatic passes

Results Stored in Separate Tables

Summary

Embedded Geocode Control Application

- Links to remote database tables using ODBC

- Provides multi-user functionality

- Can be mobile, either laptop or VPN based

- Outputs result codes that show match accuracy

- Improve geocode accuracy and completeness

- **Provides history of addresses that can be used to automate future address location**

Summary

Embedded Geocode Control Application

- **Is interactive with several tables at once**
- **Links to address reference tables**
- **Recursive link to previously geocoded addresses**
- **Provides problem logging and reporting**
- **Provides an audit trail of geocoding**
- **Records address status and type**
- **Enables Filtering by disease**

Thank You!

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